Student Clinical Report

Editor's Note: The AABP Board of Directors, meet ing in Washington, D.C. on July 21, 1980, approved a recommendation from the Forward Planning Committee to encourage veterinary medicine students to present case reports for publication in this journal. Prizes of $200, $100 and $50 are awarded for the top three reports. This year, the paper published below, by Darcy Walker, merits the $200 prize. The contribution by the students from Western College of Veterinary Medicine University of Saskatchewan receives the $100 prize.

Diagnosing Infertility in a Dairy Herd

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Introduction

This project was begun in August, 1985 on a dairy herd in Northwest Ohio. This herd was experiencing reproductive problems characterized by the dairyman as follows: 1) high incidence of metritis, 2) long interval to first estrus, 3) poor conception rates, and 4) a high number of repeat breeders. A second complaint was of a high incidence of an acute febrile disease in cows one to three day post-partum characterized by a mucous nasal discharge, dyspnea, anorexia, and diarrhea. The condition appeared to be unresponsive to antibiotic therapy and ran its course in 7 to 10 days. In an attempt to define the etiology of the problems, a complete herd work-up was initiated which included: 1) history, 2) physical and reproductive examinations, 3) nutritional evaluation, 4) laboratory diagnostics, and 5) herd health record analysis.

I. History

A. Herd History

The herd was composed of 64 lactating Holsteins including 16 first calf heifers which were added from January to August, 1985. The average midlactation cow weighed 1300#, milked 50# per day, and had a body condition score of 2 or 3 on a scale of 1 to 5. The total herd, in addition to lactating and dry cows, included 18 yearling heifers and 26 calves. The cows were milked in a stanchion barn and housed in an open lot—free stall type barn with access to a ten acre field. The calves were housed in a building that contains 8 separate pens and were weaned by 7-8 weeks of age. They were then moved into a large pen until they were 6-8 months old. The heifers were kept in an indoor/outdoor lot until they were one year old, when they were placed with the milking herd. They were bred at 15 to 16 months of age.

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B. Health History

In the first half of 1985, the incidence of displaced abomasums (DAs) was 7%, abortions about 5%, and 13% milk fever cases in 30 susceptible calvings. A majority of these milk fever cases were unresponsive to multiple treatments. Post-partum metritis occurred in nearly 75% of the cows. Uterine discharges were described as sanguious with a pungent ordor prior to 10 days post-partum and then turned purulent. Infusions with oxytetracycline, dilute iodine, and sulfa-urea were used. Prior to veterinary intervention, the dairyman began using a combined killed Chlamydia/Haemophilus vaccine in an attempt to correct the problem. In June 1985 fevers in post-mortem cows ran as high as 107° F. In addition to respiratory signs and anorexia, production decreased about 40% in affected cows for up to 2 weeks post-partum. From June until August, 1985 all sick and anestrus cattle were vaccinated every 10 days with the killed Chlamydia/Haemophilus vaccine.

II. Nutritional Evaluation

A. Materials and Methods

The first step in diagnosing herd disease and infertility cases is to identify the problem through the establishment of a sound data base. Analysis of this herd was first approached from a nutritional aspect as follows: 1) nutritional management, 2) ration analysis, and 3) use of laboratory data.

1) *Nutritional Management History:* Management questions were addressed as they related to grouping systems, rations fed, and the adequacy of facilities. Discussions with the herd veterinarian and the dairyman, along with rectal palpations, physical exams, and record analysis were performed.

2) *Ration Analysis:* This was begun by collection of feed tags and feed samples. A representative hay sample was taken by obtaining three core samples of 12 bales selected at random. Samples of silage were collected at random from

each feeding for one week, placed in airtight bags and frozen. Samples were then thawed and pooled in order to obtain a final representative sample. A grain sample was also collected. The three samples were then sent to the DHIA forage analysis laboratory in Bonduel, WI.

It was possible to gather information from the dairyman on amount of each foodstuff in the rations fed to various groups of cattle. Average daily dry matter intake of corn silage was determined by measuring the drop in silo levels over a one week period and the amount of dry matter consumed was calculated. These values along with the results of the chemical analysis were then used to formulate a ration with the Spartan Computer Ration Evaluator. (1)

3) *Laboratory Data:* The herd was divided for blood sampling purposes into nine groups. Subdivision was according to age and stage of lactation. Blood samples were collected for determination of serum vitamin A and E and mineral levels of calcium, phosphorus, magnesium, zinc, copper and selenium.

B. Discussion of Results and Recommendations

1) *Nutritional Management:* The lactating herd was fed a diet of corn silage, alfalfa hay, and ground ear corn concentrate mixed on the farm. The concentrate was fed at milking time according to production. The yearling heifers with the lactating herd received 3 pounds of concentrate per head per day. Minerals and white salt were fed free choice. The first management recommendation was to first regroup the herd with a separation of dry cows and heifers from the lactating herd. In addition to balancing the ration, possible changes in the feeding program to improve overall nutrition involved going to a Total Mixed Ration (TMR), bunk feeders with the use of magnets, or to three times a day feeding of corn silage. The overall objective was to decrease the amount of grain fed at milking.

2) *Ration Analysis:* The results of the computer analysis are summarized (Tables 1 and 2). The forage to concentrate ratio was 40% to 60% which is above the accepted 50%:50% ratio. In order to correct this, it was recommended that daily hay and silage intakes be increased.

The dry matter intake (DMI) was found to be deficient in both dry and lactating cow rations. The correction of the forage:concentrate ratio described previously would also aid in correction of this deficiency. Low DMI and excessive concentrate intakes could be related to the occurrence of DA's. The crude protein (CP) levels were high in both rations and this problem was remedied by decreasing the amount of soybean meal in the concentrate and topdressing the high producers. Addition of oats to the concentrate also aided in the establishment of adequate protein levels. The high protein levels may have contributed to the increase in days open and services per conception. Lower conception and pregnancy rates may be seen with high protein levels depending on the relative amounts of degradable and undegradable protein present. In general, high protein levels of 17-20% have a negative effect on reproductive parameters. (2)

The dry cow ration was deficient in net energy (NE). This was in spite of adequate energy density. Therefore, the deficiency was really due to a deficiency in actual pounds of dry matter consumed. Moderate energy deficiencies in lactating cows may produce inactive ovaries, repeat breeders, emaciation, abortion, and decreased milk production in severe deficiencies. (3)

TABLE 1. Computer Analysis of Nutrient Intake in Lactating and Dry Cow Rations.

Analysis	Ration Value (DM basis)	NRC Goal (DM basis)
1. Dry matter Intake (DMI)		
—lactating	36.5 lb.	39.8 lb.
—dry	18.7 lb.	23.5 lb.
2. Crute protein (CP)		
—lactating	6.41 lbs. (17.6%)	5.15 lbs. (12.9%)
—dry	3.29 lbs. (17.6%)	2.59 lbs. (11.0%)
3. Net energy (NEL)		
—lactating	27.6 Mcal	26.1 Mcal
—dry	12.9 Mcal	13.6 Mcal
4. Acid detergent fiber (ADF)		
—lactating	15.1%	>18.5%
—dry	19.5%	>24.0%

TABLE 2. Computer Analysis of Nutrient Intake in Dry Cow Ration.

Analysis	Ration Value (DM basis)	NRC Goal (DM basis)
5. Ca	1.1% (95 gm)	0.37% (42 gm)
6. P	0.37% (32 gm)	0.26% (27 gm)
7. Mg	.21% (18 gm)	0.22% (23.5 gm)
8. Zn	33 ppm (.28 gm)	50 ppm (0.5 gm)
9. Cu	9.1 ppm (.08 gm)	15 ppm (0.16 gm)
10. Se	.11 ppm (0.9 mg)	0.20 ppm (2 mg)

The acid detergent fiber (ADF) levels in both rations were low due to a low level of 18.9% in corn silage. Ideal levels for corn silage are 24-32%. (4) The anticipated effects of low ADF would be an increased incidence of DA's, decreased rumen function, and a depression of butterfat. (5) It was suggested that the corn silage be chopped coarser (1" or greater) and it should have a moisture level of 32-40% dry matter (DM). (6) Corn gluten can be fed to the high producers to increase the ADF in the diet. A rise in butterfat percent could be used to monitor the effectiveness of this change. (7)

Magnesium (mg), zinc (Zn), copper (Cu) and selenium (Se) dietary levels were low in dry and lactating cow rations. (8) Magnesium deficiencies have been associated with the milk fever/downer cow syndrome which may be of importance in this herd. In addition, excess calcium (Ca) levels in the dry cow ration would possibly accentuate this Mg deficiency by competing for absorption from the gut. Magnesium oxide was added to the concentrate to correct this problem. Also, a trace mineral salt (TMS) was used instead of white salt in the concentrate. Se levels were low and the recommended level of .1 ppm of DMI was increased to .3 ppm. Current research indicates that these higher levels may be required to maintain adequate serum levels of Se. (8) All of the trace minerals, if deficient, can potentially be causes of infertility. (3)

Calcium levels in the dry cow ration were found to be twice the recommended amount of 42 grams per day, while phosphorus (P) levels were normal. This resulted in a 3:1 Ca:P ratio. The Ca levels of 95 g/head/day which these cows were receiving was high. Research has shown that levels of greater than 100 g/head/day may increase milk fever incidence. (9) Therefore, it was recommended that poor quality hay, grass hay, or alfalfa hay diluted with straw be fed to dry cows. For lean dry cows, 3-5 pounds concentrate per head per day was recommended 2-3 weeks prior to calving. This feeding of concentrate is reported to be important in the development of rumen flora compatible with the higher concentrate to roughage ratio fed post-partum. (10)

3) *Laboratory Data:* The results of the serum vitamin and mineral levels are listed (Tables 3 and 4). Even though the Ca means appear adequate, several cows had low serum levels. Copper levels were also low. Since phosphorus values do not reflect inorganic blood levels, they were not used. Copper deficiencies may be related to retained placentas, and more importantly in this herd, infertility problems. (11) These may include inactive ovaries, and delayed estrus. Phosphorus is the mineral most often associated with infertility. If severely deficient, it can be responsible for delayed postpartum heats. Moderate deficiencies can be manifested by greater number of services per conception and more repeat breeders. (3)

Vitamin E and Se levels were low (Table 4). There is no evidence that Vitamin E alone is essential for reproduction, but in combination with very low to moderately low Se levels, may relate to infertility. (3)

TABLE 3. Serum Mineral Values (5 cows).

Analysis	Sample Mean (ppm)	Sample Range (ppm)	Normal Mean (ppm)
1. Ca	91.8	83-100	90-120
2. P*	132.4	109-161	85-170
3. Mg	22.4	19-24	15-28
4. Cu	.76	.5-.9	>0.6
5. Zn	1.2	.9-1.5	>0.1

* Total phosphorus determination

TABLE 4. Serum Vitamin Values (7 cows).

Analysis	Sample Mean	Sample Range	Normal Mean
1. Vit A (ng/ml)	679	471-975	>400
2. Vit E (ug/ml)	1.18	.8-1.41	>2.0
3. Se (ug/ml)	.047	.026-.060	>.07
4. Carotene (ug/ml)	1.31	.96-1.85	>2.0

III. Herd Health Evaluation

A. Materials and Methods

The second part of this herd analysis and data base included evaluation of reproductive and herd health management as well as the laboratory data.

1) *Management History:* Discussions with the farmer about heat detection, breeding practices, vaccination programs, and records again resulted in more information for the data base.

2) *Herd Record Analysis:* This was done by compiling all of the data kept on several calendars, breeding charts, and notebooks on one master list. This data contained all cows calving from January 1984 to December 1985. Also compiled on this chart were number and dates of services, intervals to estrus and breedings, cases of cystic follicles, milk fevers, abortions, retained placentas, post-partum sickness, calf mortality, and vaccination history. All of the appropriate ratios could be calculated from this information.

3) *Laboratory Data:* The herd was divided as described under nutritional evaluation for sampling: Blood samples were collected for determination of serum titers to Leptospirosis, Infectious Bovine Rhinotracheitis (IBR), Bovine Virus Diarrhea (BVD), and Haemophilus. Packed cell volumes (PCV) and Total Proteins (TP) values were also determined and recorded. Additional samples were submitted as follows: uterine and vaginal swabs from repeat breeders and ureaplasma suspects, and fecal samples for determination of parasite burdens.

B. Discussion of Results and Recommendations

1) *Reproductive Management:* Estrous detection was performed by the dairyman prior to and after the morning and evening milkings and during the day when the cows were not eating. In 1984 the breeding was done by artificial insemination (AI). In the first half of 1985, a bull raised from within the herd was with the cows. From June to August, 1985 a purchased bull was with the herd. Breeding usually was done on the first estrus observed approximately 60-70 days post-partum based on the primary sign of standing heat. Some breeding according to secondary signs with the aid of heat detectors was also done. Cows were bred more than once if still observed standing in heat 12 hours after the initial insemination. Cows observed in heat in the morning were bred the afternoon or evening of the same day. Cows observed in heat in the afternoon or evening were bred the following morning. Pregnancy exams were performed at 40-60 days post-breeding.

The vaccination program for the past 30 months consisted of using a killed vaccine for IBR, BVD, PI-3, Leptospirosis, Vibriosis and Haemophilus/Chlamydia combination. Cows were vaccinated several weeks before and after calving. Modified vaccines for IBR and BVD were used prior to this time.

2) *Herd Record Analysis:* Results are shown (Table 5). The days to first estrus was 64 in 1984. This means that heats were not detected until after 60 days post-partum or that cows were just not cycling. In comparison with the days to first breeding, it is obvious that most cows are bred on the first observed heat. In the first six months of 1985, the values to first estrus decreased to 44 and the interval to first breeding to 55 respectively. This improvement was possibly due to improved management, the bull's presence in the herd, or a combination of factors. Most cows should be in estrus by 20 days postpartum and observed by 35 days. This is because there is often a short cycle after the early first post-partum ovulations. (12) The longer value in this herd may be due to inadequate heat detection or due to disease conditions. If there are no heats detected by 45 days, cows should be examined for possible pyometras, inactive ovaries and cystic follicles. (13)

TABLE 5. Results of Record Analysis.

Criteria	1984	1985 (1-6)	1985 (7-11)	Goals
Cows (No.)	46	24	15	
Interval to first estrus (days)	64	44	50	30
Interval to first breeding (days)	70	55	50	60
Open (days)	103	86	70	100
First service conceptions (%)	50	33	40	65
Services per conception (No.)	1.7	1.7	1.3	1.5
Repeat breeders (%)	13	17	13	10

The days open also decreased as the interval to first breeding decreased. This value is consistent with the goals which indicates that breeding efficiency is good and timing of insemination is right. It was recommended that one person be responsible for heat detection for approximately 20 minutes in the early morning and late afternoon or evening at times when cows are not eating. Records should be kept on calving dates, heat detection, breedings, reproductive exams, and treatments. (14, 15)

The first service conception (FCS) rates decreased and this may be due to bull infertility or because cows were being bred earlier post-partum when conception rates are lower. Services per conception were slightly above the goal of 1.5. (16)

3) *Laboratory Data:* The results of the titer analyses are recorded (Tables 6, 7, 8). The Leptospirosis titers ranged from zero to 1:800 in 2 cows of 12 sampled. Titers of up to 1:400 can be expected from vaccination alone, but values greater than this could indicate natural infection. Paired analyses were not done due to a mix-up in laboratory communication, but paired samples from acute and convalescent cases with at least a four-fold increase in titers would be desired to help establish a diagnosis. (17)

IBR titers of greater than 1:32 are indicative of exposure to the virus and cannot be attributed to a vaccine-induced response. The titers in Cow B are much higher. (18, 19)

TABLE 6. Results of IBR Serum Titer Analysis.

Cow	Pre	Post	Change
A	1:4	1:8	2x
B	1:2048	1:1024	2x
C	1:16	1:8	2x

Table 7. Results of Haemophilus Serum Titer Analysis.

Cow	Pre	Post	Change
D	1:2048	1:4096	2x
E	1:512	1:512	0
F	1:2048	1:1024	2x
G	1:1024	1:512	2x
H	1:32	4:4	8x

TABLE 8. Results of BVD Serum Titer Analysis.

Cow	Pre	Post	Change
I	1:1024	1:256	4x
J	1:32	1:16	2x
K	1:1024	1:128	>4x
L	1:4096	1:512	>4x

Haemophilus titers of up to 1:256 may be due to vaccination, but titers greater than this are possible due to agent exposure. These titers may reach 1:4096. (20)

The BVD virus vaccine is so much more immunogenic that titers as high as those reported can be attributed to the vaccine. It is possible, however, that exposure to field virus occurred. Virus isolation from nasal swabs or the buffy coat portion of a blood sample is more diagnostic. These cows have seroconverted and are not immunotolerant. Even so, this does not preclude the possibility that there may be some individuals in this herd that are immunotolerant. (21, 22, 23) It was recommended that vaccination should be performed on healthy susceptible cattle not under stress. The vaccination program should be initiated in replacements at 6-8 months of age and repeated as indicated. (24)

Cultures were taken from cows with small red blisters on the walls of the vulva and from some cows with tenacious discharges. Four of four cows sampled were positive for ureaplasma; however 20% of normal cows may harbor this organism. (25) Ureaplasma has been reported to be associated with early embryonic death and a high incidence of returns to heat after pregnancy diagnosis at 40-45 days. Purulent discharges are often present. Artificial insemination should be used to decrease the spread of ureaplasma by natural service. Sheathed rods should be used when the uterus is entered for breeding or infusing. Prebreeding vaginal flushes or post-breeding uterine infusions can be used as a control measure.

Uterine swabs from three cows were submitted for bacteriological examination. They were positive for Strep, Staph and *Corynebacteria pyogenes.* Again, these were possible causes of decreased fertility. It was recommended that nutritional parameters be corrected and that infusions be done conservatively according to sensitivities. It has been recommended that cattle be examined at 20-45 days postpartum and after breeding. (26, 27, 28)

Fecal samples contained 4-5 eggs per low power field. All cattle were wormed with a preparation placed in the field.

Packed cell volumes of 25-30 with a mean of 28 were reported in 12 cows. Normal mean values greater than 30 are desired. Research has shown that once PCV values drop below 30, there is an increased incidence of repeat breeders and difficulty detecting cows in heat. (29) The low PCV values could be due to the parasite burden, but also ration imbalances and TMS deficiencies can have this effect.

Clinical Response to Changes

Some of the immediate changes made in the herd included: a return to artificial insemination with the use of sheathed rods, a continuation of post-breeding infusions, and when necessary, and correction of the nutritional imbalances in Se, Ca and P levels. From August, 1985 to January, 1986, the incidence of milk fevers decreased to zero and there were no DA's, abortions, or sick cows post-partum. The butterfat percent rose 0.3%. The values from the last half of 1985 show that following a return to AI, cows were observed in heat and also bred at 50 days post-partum (Table 5). The 15 cows that conceived did so on the average at 70 days after calving. There was a slight increase in FSC rate, but a decrease in services per conception and repeat breeders. In March of 1986 cows again began to show signs of acute illness post-partum. Paired sera samples from acute and convalescent cases resulted in high IBR titers, but no four-fold changes. Virus isolation from nasal swabs of acutely ill cattle is being planned at this time.

Summary

After collecting the history, completing physical and reproductive examinations, evaluating the ration and laboratory data and analyzing the health records, we arrived at the conclusion that this infertility problem had no single diagnosis. Multiple factors interrelate in the etiology of most periparturient diseases and herd infertility problems, including nutrition, infectious diseases, and management. The stress of nutritional imbalances along with the possibility of the presence of Leptospirosis, Haemophilus, IBR, and BVD may have been factors in the etiology of the metabolic and periparturient diseases and infertility in this herd. The milk fever was attributed to the imbalances of calcium and phosphorus in the dry cow ration. All of the above factors interrelate and can cause reproductive inefficiency which may manifest as a delayed onset of estrus, increased services per conception, and a high number of repeat breeders. In order to prevent conditions similar to these from developing, four basic recommendations should be followed: 1) Balance ration, 2) Keep accurate records, 3) Evaluate records, 4) Implement complete herd health program. Infertility problems are often subtle and require teamwork between the dairyman, nutritionist, and veterinarian. Correction of a multitude of relatively minor problems can result in major improvements in both herd health and reproductive parameters and profits.

References

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